Space Weather Technical Forecast

Issued on Sunday, 23 October 2022 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/Minor to G2/Moderate Storm expected on day 1 (23rd)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with several, mainly small C-class flares observed. A C6 flare at 22/0542 UTC was from AR3122 that has rotated over the northwestern limb. There are currently four sunspot regions on the visible Sun, however these are all currently small and simple regions.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, was at background levels for most of the period, before increasing to slightly-elevated values close to 400 km/s at 22/2018 UTC. The density was at above average levels, reaching a peak of 29 ppcc at 22/1703 UTC. After 22/1800 UTC density decreased to average levels. The IMF was mainly moderate at or just above 10 nT. The north-south component Bz started positive, however, became more generally moderately negative from around 22/0700 UTC. A peak value of -11 nT was observed at 22/1221 UTC, at 22/1906 UTC Bz became weekly positive before returning to Moderate negative values from 22/2215 UTC. The phi angle has been positive (away from the Sun) until 22/1702 UTC when it rotated into a negative (towards the Sun) orientation. Geomagnetic activity was Quiet to Unsettled, but became Minor Storm (Kp5/G1) between 22/1500-2100 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16 has remained at Background levels. High energy electron flux (greater than 2MeV) at GOES16 was at normal background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.93e6 integrated pfu observed at 22/2359 UTC.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is most likely to continue Low, perhaps falling to Very Low, but with a slight chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast period. Solar winds are expected to continue to strengthen as the High Speed Stream from negative coronal hole 34 becomes established, most likely becoming Elevated to Strong, with a slight chance of becoming Very Strong. This is low confidence in respect to both timing and strength, and is mainly guided by current Enlil expectations as well as a notable enhancement observed by STEREO A. The fast winds will likely persist into day 2 (24th), before potentially easing day 3 (25th). Geomagnetic activity is expected to be Active to G1/Minor with a chance of G2/Moderate storms on day 1 (23rd). Quiet to Unsettled with isolated Active intervals are then expected from day 2 (24th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at Background. High energy electron flux (greater than 2MeV) as observed by GOES16 is expected to peak at Moderate levels. A gradual rise to mainly High levels is then expected by the end of the period. The associated 24 hour fluence is expected to remain below Active (1e8 integrated pfu) at first, before rising late in the period, with a chance of rising above day 4 (26th).

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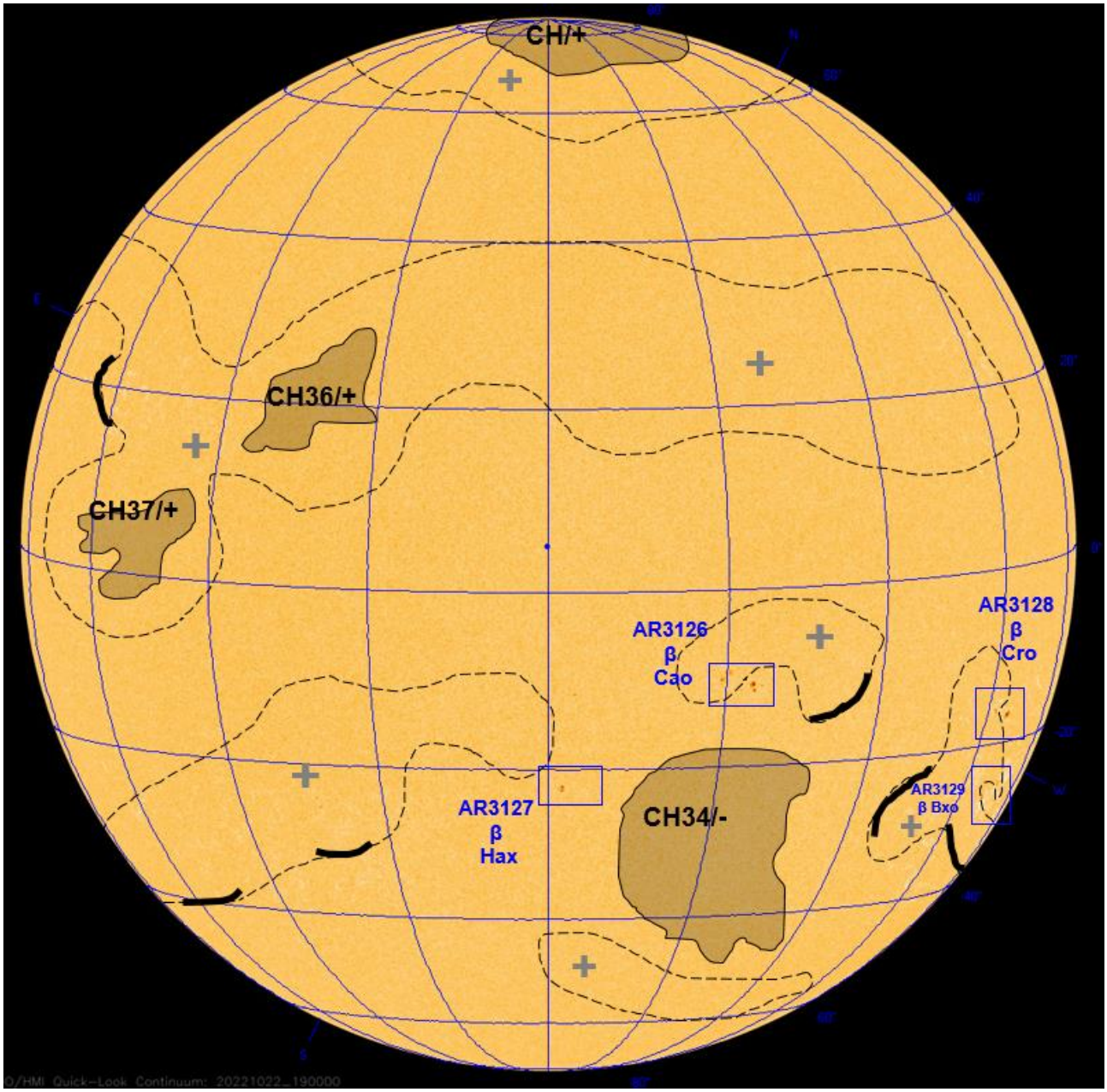
Figure 1. Solar Analysis Valid 22/1900UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

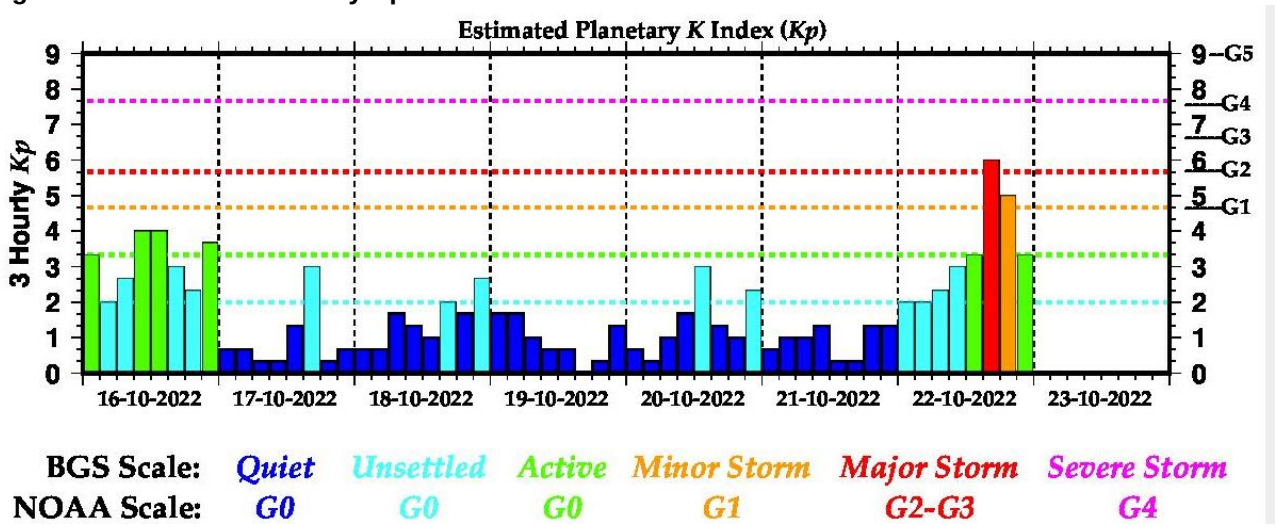
No Earth-directed CMEs currently feature in the forecast period.
The main feature of interest for this forecast period is the large southern negative polarity CH34. This is a recurrent CH with similar appearance to the previous rotation and, with persistence indicating an arrival on day 2 (24th), and resultant solar wind speeds of 550 km/s. Conversely, however, MOSWOC Enlil is indicating a much earlier arrival, with solar winds peaking at 600 km/s early day 1 (23rd). Solar wind speeds have increased from background to slightly elevated levels, perhaps indication the arrival has started.
Consequently solar winds at Earth are expected continue to increase, likely reaching speeds of around 550-700 km/s. These Elevated to Strong winds (perhaps briefly Very Strong) will likely persist day 2 (24th), before gradually easing day 3 (25th).

Geomagnetic activity is expected to be Active to G1/Minor storms with a chance of G2/Moderate storms day 1 (23rd). Quiet to Unsettled with isolated Active intervals are then expected from day 2 (24th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	90	20	1	1
Strong	G3	No	10	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: Estimated Planetary Kp from BGS



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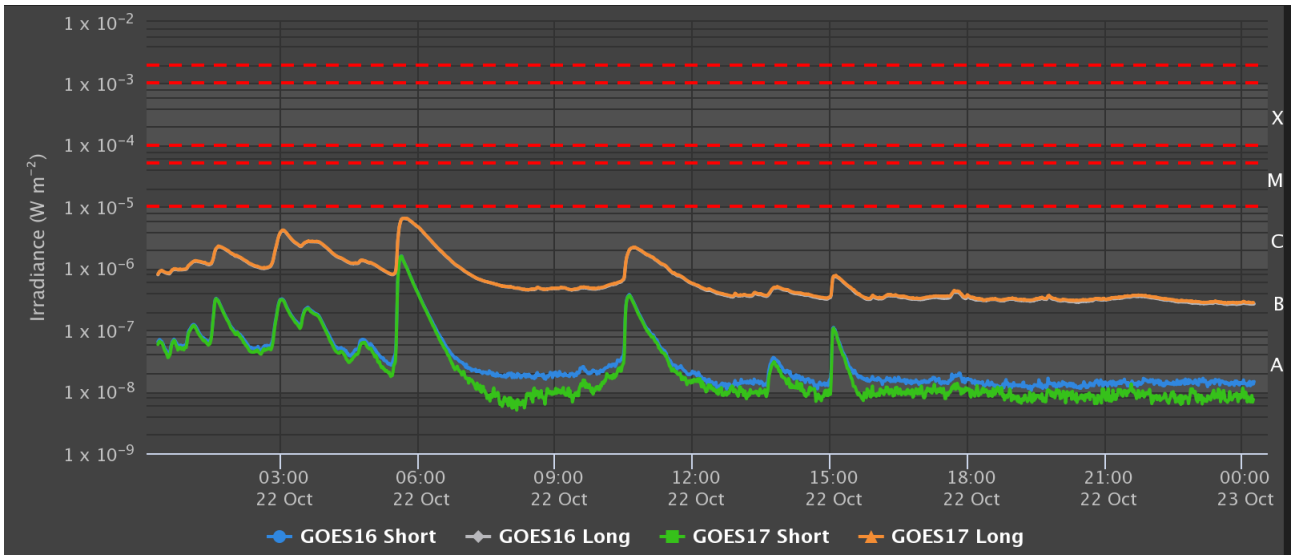
Radio Blackouts - X-Ray Flares:
Solar activity is currently Low, with four sunspots on the Earth-facing disc. Low activity is expected to continue, perhaps falling to Very Low, but with a slight chance of increasing to Moderate levels.
There are four sunspots on the Earth-facing disc, however these are all relatively small and simple. Recently numbered AR3129 in the far southwest remains a Bxo/Beta region, with no definitive penumbra at present. As it approaches the western limb, analysis of this feature will become increasingly difficult. AR3128 (Cro/Beta) and AR3126 (Cao/Beta) in the southwest have decayed since the previous analysis with no significant flaring observed. AR3127 (Hax/Alpha) near the southern centre disc also appears to be fading. Elsewhere there are a number of small, faint pores in the southern hemisphere, but these are not significant enough to warrant including in the analysis at present.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 X-Ray flares



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at Background and expected to stay at this level.

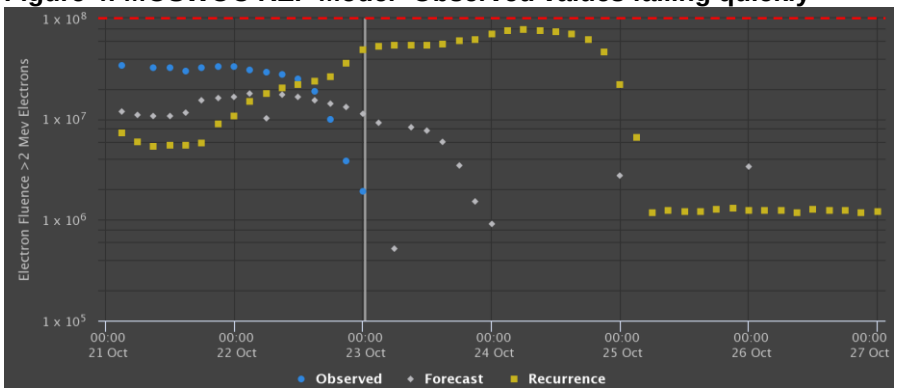
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has been predominantly background on the 22nd. The High Speed Stream from CH34/- is likely to become established on day 1 (23rd). There is significant uncertainty on both the timing and strength of this arrival, and hence in any subsequent increase in the observed electron flux. As solar wind pressure likely eases through day 3 and day 4 (25th and 26th), flux levels are likely to rise and are expected to become mainly High by the end of the period.
The associated 24 hour electron fluence is expected to remain below Active, but rising late in the period, especially as solar winds ease. There is a chance of Active fluence by day 4 (26th).
REFM is providing good guidance until T+24, but should be used cautiously beyond this due to the potential earlier fast wind arrival compared to persistence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	20	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	2	5

Figure 4: MOSWOC REF Model- Observed values falling quickly



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